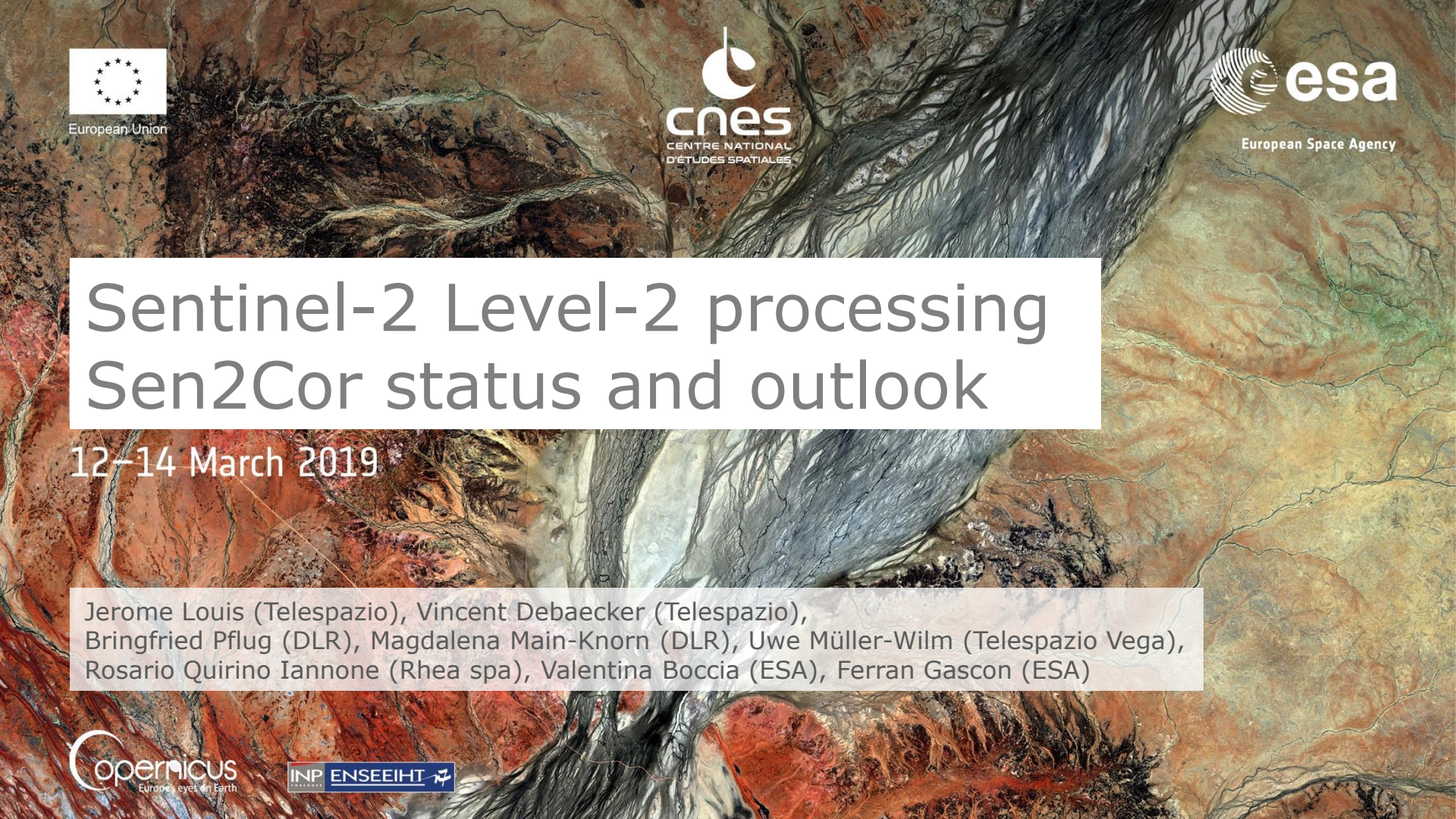

European Union
cnes
CENTRE NATIONAL D'ÉTUDES SPATIALES
esa
European Space Agency
→ 3rd SENTINEL-2
VALIDATION TEAM MEETING
12–14 March 2019
Copernicus
Europe's eyes on Earth
INP ENSEEIHT



Sentinel-2 Level-2 processing Sen2Cor status and outlook

12–14 March 2019

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Rosario Quirino Iannone (Rhea spa), Valentina Boccia (ESA), Ferran Gascon (ESA)

Outline

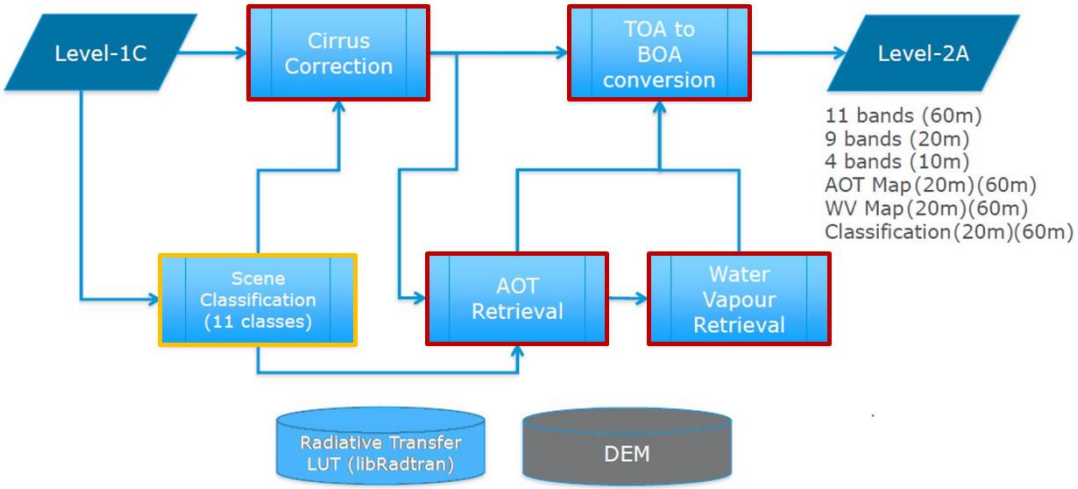
1. Sen2Cor processor overview
2. Sen2Cor versions (TOOLBOX) – L2A processing baselines (PDGS)
3. Evolutions since last S2VT
4. L2A Product Quality Overview
5. Future evolutions
6. Recommendations / Discussion

Sen2Cor processor overview

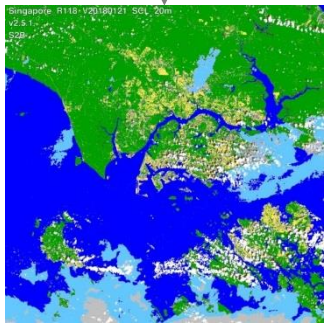
Atmospheric correction processor for Sentinel-2 data

Two main modules :

- Scene Classification (SCL)
- Atmospheric Correction (AC)



TOA-RGB (L1C-input)



SCL (L2A-output)

BOA-RGB (L2A-output)

Sen2Cor versions

General User's version:

Version 2.5.5 released on March 19, 2018 (publicly available)

Version 2.8.0 released on March xx, 2019 (publicly available)

S2 PDGS versions:

Version 2.6.x released to ESA on April 24, 2018

…

Version 2.7.1 released to ESA on November 8, 2018

Version 2.8.0 released to ESA on February 20, 2019

Level-2A Processing Baselines

- RAM consumption less than 4GB
- L2A OLQC reports included

Level-1C evolutions (L1C PB 02.07)

- OpenJPEG 2.3 faster reading time
- Topographic correction extended

PB 02.08 (Sen2Cor v.02.06.03) 23 May 2018

PB 02.09 (Sen2Cor v.02.06.06) 8 Oct 2018

PB 02.10 (Sen2Cor v.02.06.06) 6 Nov 2018

PB 02.11 (Sen2Cor v.02.07.01) 21 Nov 2018

PB 02.11 (Sen2Cor v.02.08.00) Mar 2019

- Single retrieval of atmospheric parameters (AOD & WVP) at 20 m
- Resampling of 20 m to 60 m
- Scene Classification using ESA CCI Data package
- Spatial homogeneity improved: blue path radiance rescaling -> OFF

- Terrain correction under clouds disabled
- PDGS Optimizations (dual databases)

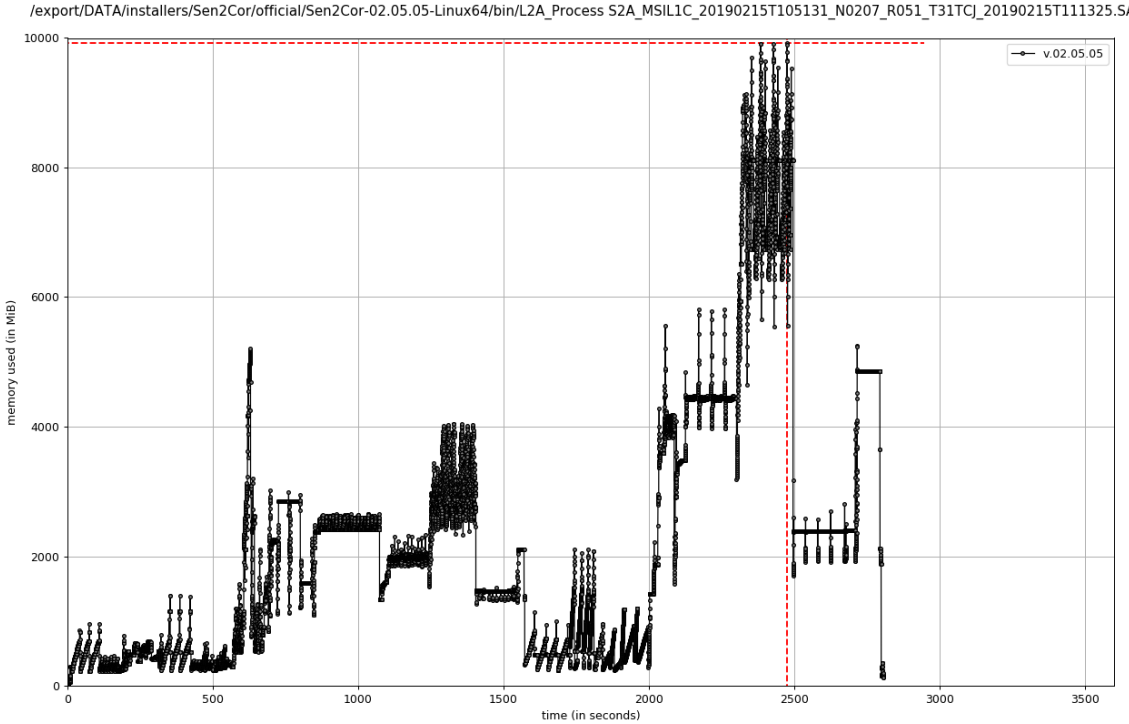
Worldwide L2A production since 14 December 2018

L2A evolutions

RAM consumption & processing time optimizations

Version 2.5 ->

Max 10 GB
46 minutes

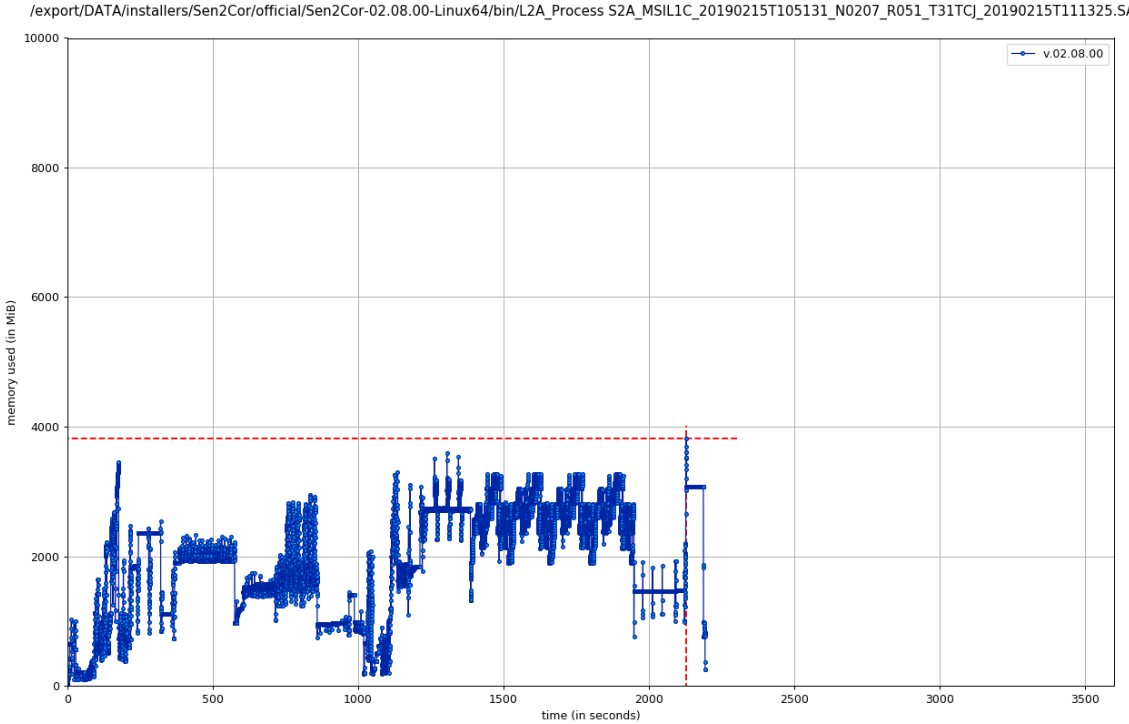


L2A evolutions

RAM consumption & processing time optimizations

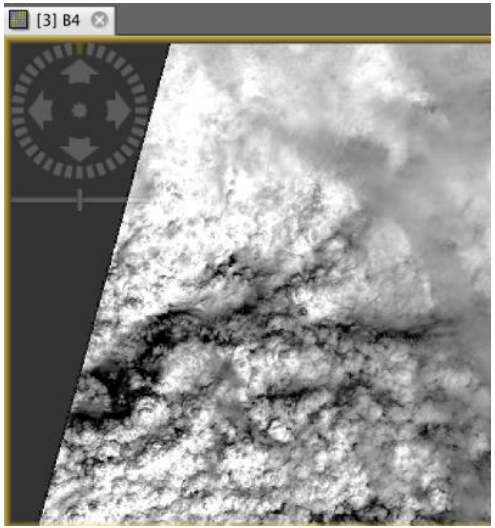
Version 2.8 ->

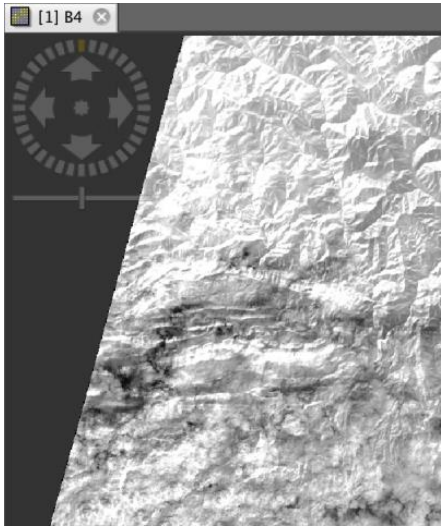
Max 4 GB
36 minutes

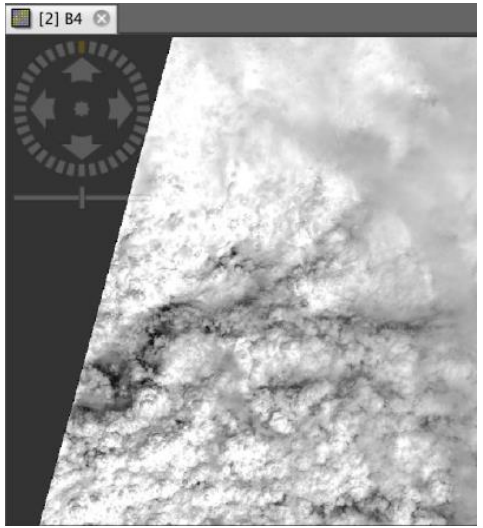


L2A evolutions

No terrain correction under clouds since PB.02.11 (21 Nov 2018)







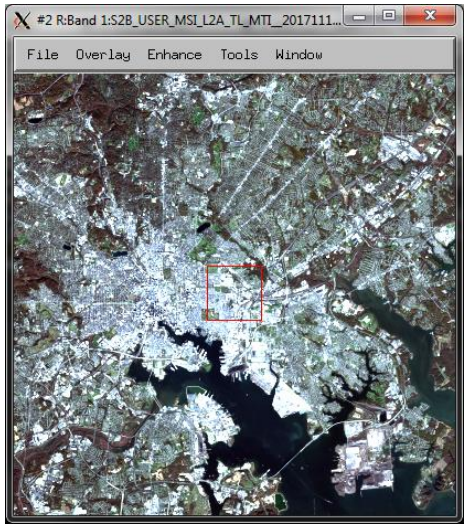
Band B04, Tile 32TLP from orbit S2B 7098.

L1C | L2A before | L2A after

L2A evolutions

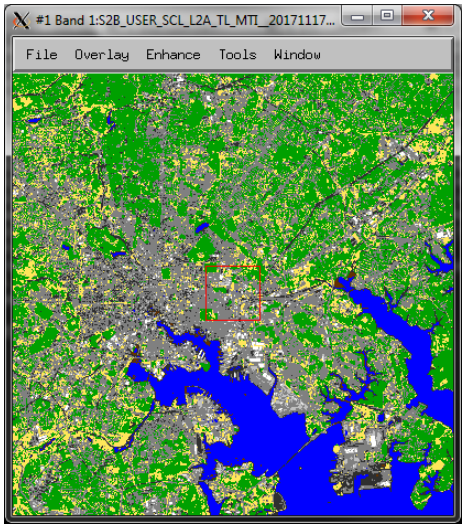
Scene Classification using ESA CCI Data package (8 Oct 2018)

L1C RGB



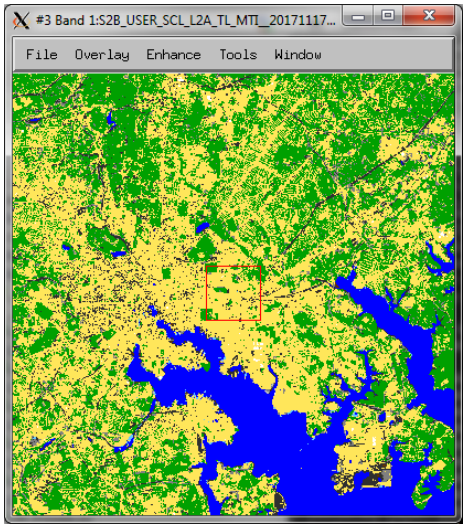
Tile: 18SUJ

Before PB.02.09



Date: 20171117

Since PB.02.09



Area: Baltimore, US

Differences between DHUS and Toolbox

Category of difference	Difference	L2A DHUS	L2A TOOLBOX
Product format	HTML folder	Yes	No
Product format	Manifest	Generated by L2A packager	Generated by Sen2Cor
Product format	Product Quality Metadata	Generated by L2A OLQC	Copied from L1C
Radiometry at pixel level	Digital Elevation Model	PlanetDEM	e.g. SRTM
Radiometry at pixel level	JPEG2000 encoding library	Kakadu	OpenJPEG

L2A Product Quality Overview

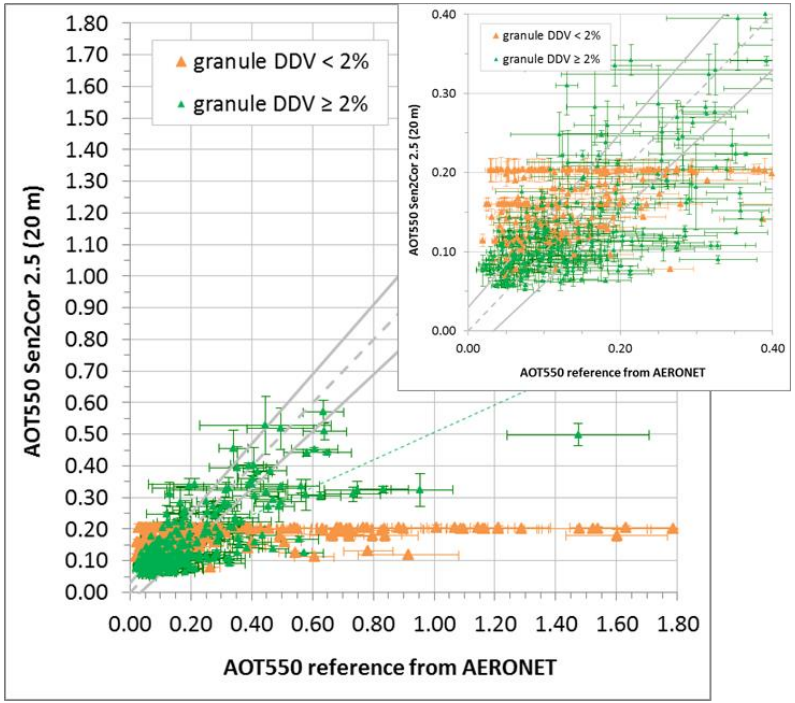
- Radiometric Performance Assessment of Sen2Cor Version 2.8
  B. Pflug (DLR)

- Validation of Sen2Cor 2.5 cloud masking and classification
  M. Main-Knorn (DLR)

L2A Product Performance reported in the monthly L2A Data Quality Reports:

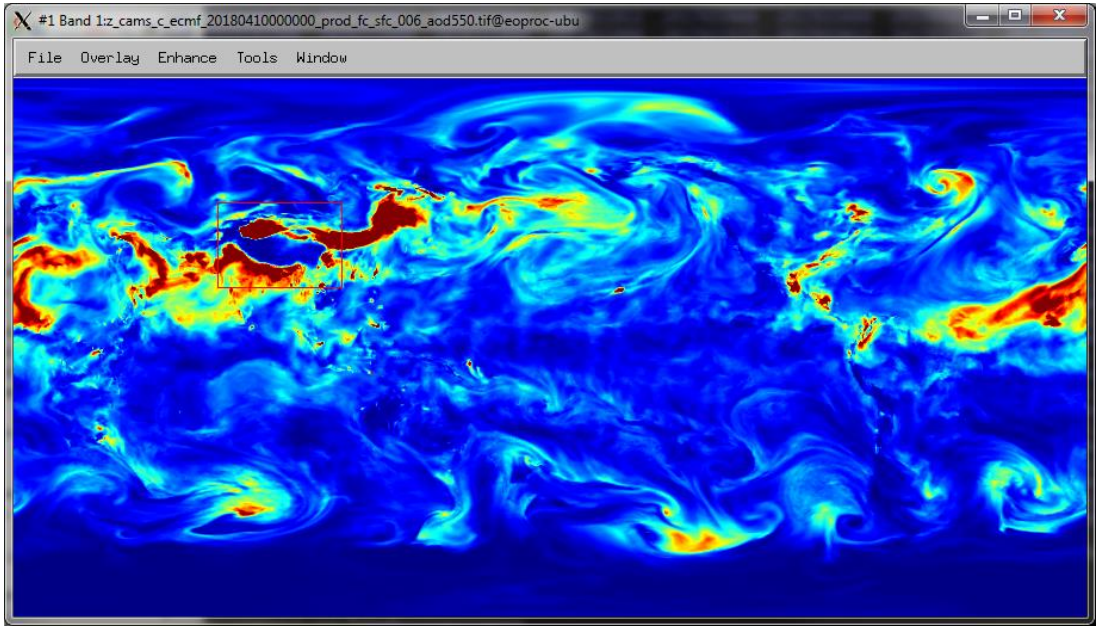
https://sentinels.copernicus.eu/web/sentinel/data-product-quality-reports
https://sentinel.esa.int/documents/247904/685211/Sentinel-2-L2A-Data-Quality-Report

L2A Product Quality Overview



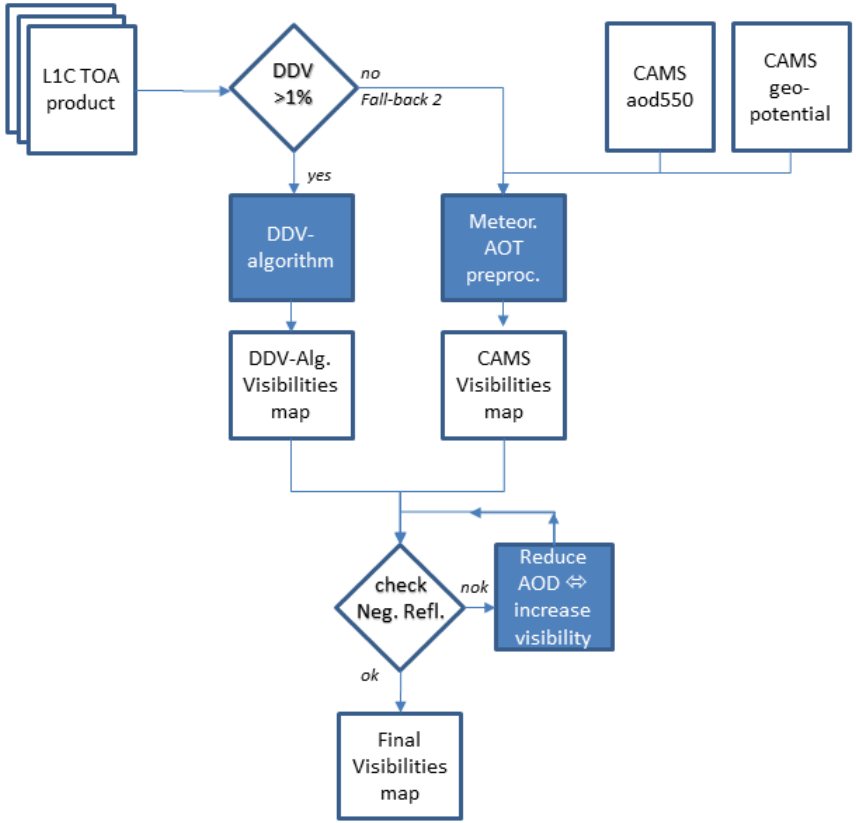
Correlation plot of Sen2Cor AOT_{550} retrieval at 20 m resolution over AOT_{550} reference from AERONET on basis of a data set at 25 AERONET sites.

Future evolution: Sen2Cor-CAMS prototype



Example of CAMS aod550 product 0.4 x 0.4 deg lat-lon grid
source: Copernicus Atmosphere Monitoring Service (CAMS)

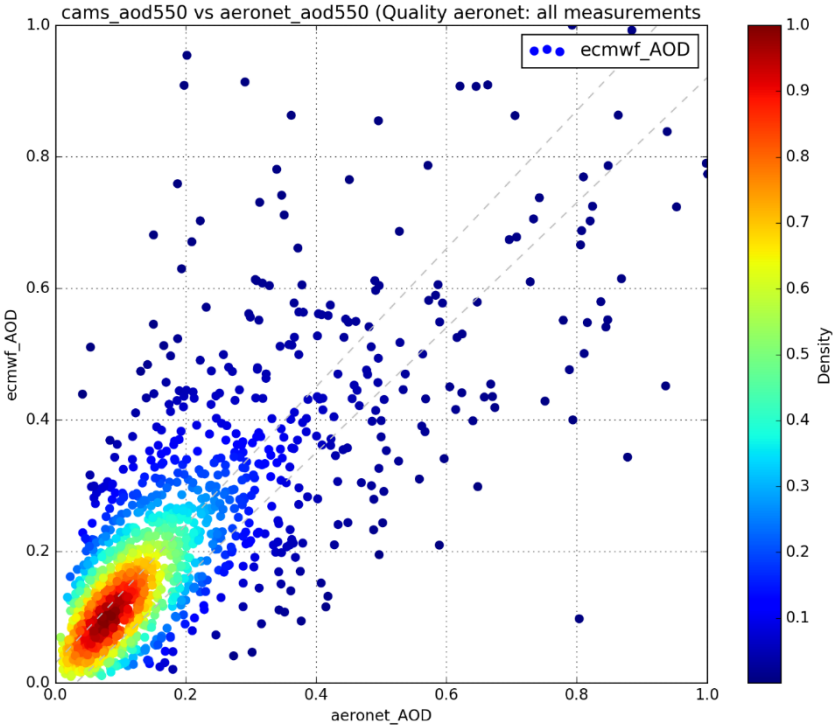
Future evolution: Sen2Cor-CAMS prototype



- Fall back solution when DDV pixels are missing in the image.
- ECMWF-CAMS Total AOD at 550 nm short term forecast (< 12 hours)

- Sen2Cor CAMS prototype developed by TPZ F
- Validation performed by ESL L2A Validation team

Future evolution: Sen2Cor-CAMS prototype

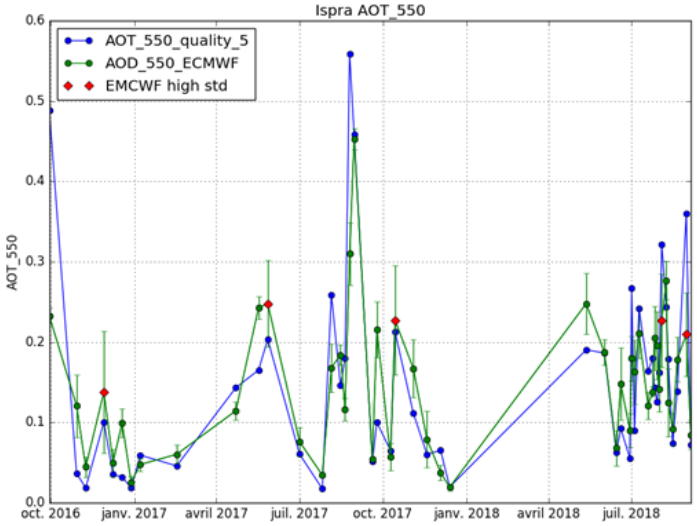


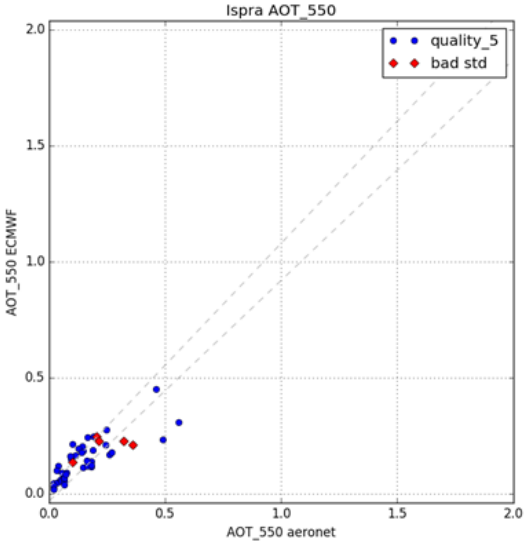
Nsamples: 1442

Slight overestimation in the range [0, 0.2]:
Bias: ~ 0,03
Slope: ~ 1,06

Future evolution: Sen2Cor-CAMS prototype

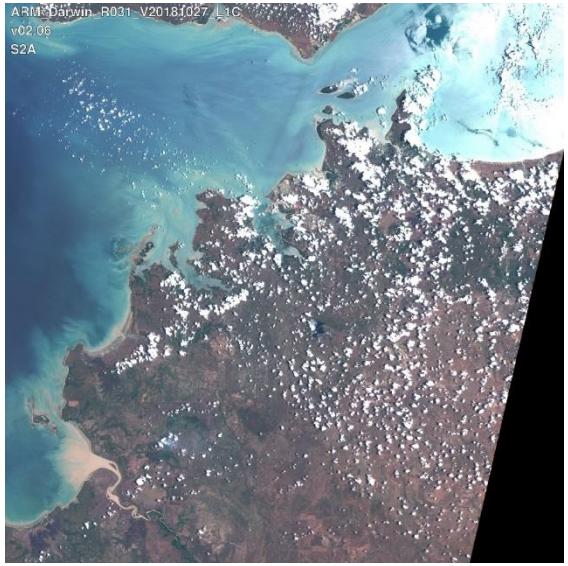
Ispra aeronet station (Italy) vs ECMWF-CAMS AOD @550 nm



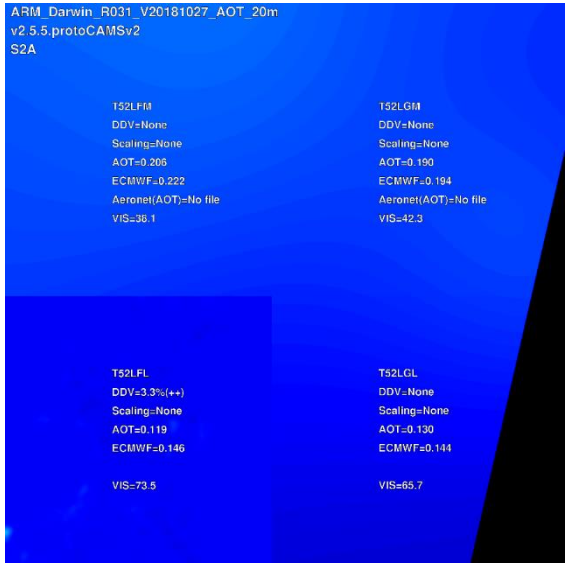


Future evolution: Sen2Cor-CAMS prototype

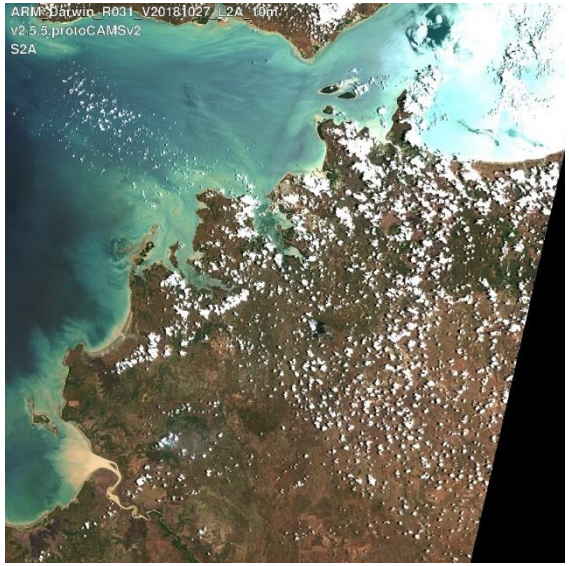
Darwin, Australia (4 tiles mosaic)



L1C



AOD



L2A

Future evolution: Scene Classification

- Dark area pixels class limited to:
  - topographic shadows,
  - tree shadows, building shadows
- Improved casted shadow algorithm with support of next 30 m DEM
- Limit false cloud detection on bright pixels
- Limit false snow detection in clouds
- Improve cloud shadow detection

Recommendations / Discussion

- Use of a Digital Elevation Model (DEM) in Sen2Cor to improve scene classification
- Download and install ESA CCI auxiliary data package
- Use the default configuration shipped with Sen2Cor v.02.08.00

- Careful with L2A products acquired with Sun-Zenith Angle (SZA) higher than 70°

External links and references

- L2A products available on OpenHub

  https://scihub.copernicus.eu/dhus/

- Sen2Cor version 2.8 for SNAP Toolbox (soon) available at:

  http://step.esa.int/main/third-party-plugins-2/sen2cor/

Thank you for your attention !

Sentinel-2 Level-2 processing: Sen2Cor status and outlook

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